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**Rock Products**  
**AGRICULTURAL LIMESTONE IS COMING INTO ITS OWN**  
 Low a Limestone Producer and Promoter Convinced Himself of the Efficacy of Agricultural Ground Limestone  
 By W. S. Halladay

Manager of Soils Bureau, Wisconsin Limestone Co., Waukesha, Wis. Reprint from Rock Products Journal  
 In the course of a year's work you meet with all kinds of argument relative to agricultural limestone, and before one has followed the work for long, if you are really interested in the progress of better agriculture, as well as the manufacture of agricultural limestone, you are forced to recognize the following important problems:

First: What functions does limestone perform in the soil? Second: What must constitute a perfect agricultural limestone? Third: What condition must be proved? You first of all realize that this condition makes it necessary that you be willing to put your best effort into the work, and spend the time necessary to work out each point, and prove by actual test the value of different materials, and the result of the same in actual work. It was some years before I realized the conditions, decided to stay with the work, and stand or fall by proved tests, but I am pleased to say that in 1920 facts have been proved not only to my satisfaction, but by my own efforts, but the results were recognized and acknowledged by soil experts, so we are still standing. I will try and review the work in as brief a way as possible, and also give you some reasons why it was necessary for the facts to be proved that agricultural limestone might receive justice in the reclaiming of depleted soils.

All companies selling fertilizers as well as many state agricultural colleges, refused to accept agricultural limestone in the list of fertilizers, claiming it was not a fertilizer but a "soil neutralizer," yet Prof. Chas. E. Thorne of the Ohio Agricultural College has said, "with out lime there can be no life, either animal or plant." The late Dr. Cyril G. Hopkins, Chief of the Agricultural College of Illinois, said "the only fertilizers not naturally produced on the farm itself are ground limestone and ground rock phosphate."

Dr. H. J. Wheeler, formerly with the Rhode Island Agricultural College and now with the Agricultural Service Bureau of Boston, said, "liming is the most economical basic treatment of the soil known, in fact no other basic treatment is either so economical or lasting, or is followed by such general good results as liming." Prof. Chas. E. Thorne of Ohio again said, "every other fertilizer material, including farm manure, depends on the lime supply."

And yet in the fact of the above statements from the three greatest authorities on soil building and fertilizers we have ever had, men to whom the farmers were looking for instruction, would claim limestone could not be considered a fertilizer. Webster defines a fertilizer: Any material used as a manure for land. Manure is defined: Any fertilizing substance used for enriching the soil.

To fertilize is defined: To make fertile, render more fruitful. To prove then that ground limestone was actually a fertilizer it was necessary to prove that it would make soil more fruitful.

With these facts before me I decided to personally make the test **My Own Test**

I secured a tract of land that had received no soil treatment of any kind for twenty-five years, and had become depleted almost to the point of non-production.

In the fall of 1919 I limed the soil with a heavy application of ground limestone and let it lay over winter on fall plowing. In the spring of 1920 I personally prepared the seed beds and planted on the 17th, 18th and 19th day of May.

On October 21st I made a display of a variety of the crops in my garage, which I photographed, and which was claimed by our county agricultural agent to be the finest display and largest variety he had ever seen in Waukesha County from one farm.

It has taken time to work out this plan of proof, but I have positively proved that Webster, Hopkins, Wheeler, and Thorne are correct and that ground limestone is just as much a fertilizer, in the fact that it will singly and alone render land more fruitful than any other substance used as a fertilizer, and is a fertilizer beyond any question whatever.

A "Perfect" Agricultural Limestone During the time of experimental work to prove limestone a fertilizer many interesting facts have also been proved relative to what constitutes a "perfect" agricultural limestone, which I believe will be interesting to those following this line of work.

At the beginning I felt certain of one thing; that to be of value a stone must of necessity be soft and soluble. This was contradicted by many soil men of experience, who

claimed that a soft material was unnecessary, so long as the material was finely ground. It was very soon demonstrated that a hard rock finely ground did not give the results attained by a soft stone more coarsely ground. After this was proved, other tests were made and the vital points studied to ascertain if possible what grinding and class of material was best for the most economy in use. It was discovered that with a rainfall of 29 to 30 in. per annum, 2 1/2 lbs. of calcium was leached out of the soil for every cubic foot of water passing through it and that the finer the material was ground the more subject to leaching it was. This proved that in a section of plentiful rainfall the leaching was a heavier drain on calcium in the soil than was the cropping.

Coarse grades of limestone were tried out, only to find that the soft soluble stone would give results where the hard rock of the same grinding would not produce for three years, thus proving the soft stone was preferable and more satisfactory, being more economical to use and giving desired results.

On further investigation it was found that experiments at state agricultural stations making tests for the past forty years had decided on a material consisting of a combination of powdered material mixed with a material a little coarser, and on account of this being found most economical in use and most efficient for results, laws have been made in some states regulating the grading accordingly.

With these facts at hand, I was forced to realize that in our state, where agricultural limestone is being offered, in nearly every case the material was a waste material or a by-product; no special agricultural limestone was being offered and that to give the farmers what they really expected and were entitled to a strictly agricultural limestone plant was necessary.

I therefore secured a quarry, recommended by W. W. Weir, recently professor of the soils department of the University of Wisconsin, as the best agricultural limestone in the state and put into existence the Wisconsin Limestone Co., which at present is constructing a strictly agricultural limestone plant that will be run exclusively to produce a material which my tests have proved to be the most economical to use and one that will guarantee the results expected.

The agricultural limestone industry is in its infancy. It must come into its own, for without it agricultural production will continue to be less and less each year.

We should be positive about one thing in the manufacture of agricultural limestone: that the farmer receives that which is best and most economical for his use, for one failure in a district kills the use, of the material for a long period of time and is not only a loss to the manufacturer, but to the farmers as well.

I will be pleased if the proved results assist anyone in the work and encourage the manufacturer who has the right kind of material to put his product in the correct combination for a perfect result. I will be pleased to assist anyone by further information on the tests I have made.

Our soils bureau is maintained for the purpose of giving free instructions and information relative to soil building and general farming.

**Rare Minerals, Metallurgy, Chemistry ROCK PHOSPHATE**

TORRANCE, March 25.—Question: Reply to yours to Walker, our superintendent, Torrance Lime and Fertilizer Company. Herewith larger samples; shark teeth, tusks, bones, etc., found in same deposit. Answer: Correspondents will read with pleasure that the greatly desired rock phosphate will, in all probability, be an added asset to the mineral wealth of California.

Today, after running down many reports and in analyzing many minerals from the mining boys in the hills, we find it is probable that California will be in a position to mine phosphate rock in sufficient quantity to meet all requirements. The samples sent to us from Torrance are rock phosphate running high in phosphoric acid. They are of blackish-brown color and from their worthless-looking appearance, at sight, have probably been unnoticed for 10, these many years.

**NEWER ASPECTS OF SOME NUTRITIONAL DISORDERS**

(By Alfred F. Hess, M. D.)

"It has been found in Victoria, for example, that cattle raised on certain pastures develop paralysis and other infirmities which can be cured by fertilization of the soil. In the United States in some areas it is impossible to maintain cattle in good condition until the forage is improved by mineral or animal fertilizers, which illustrates that a deficiency in plant tissues leads to nutritional disorders in animals, and this also applies to men. Recently Hart, Steenbock and Humphrey have confirmed these observations by careful experiments which showed how the mere addition of calcium to the fodder of cows prevented the birth of premature, weak or dead calves. Indeed, the extensive investigations of Forbes showing that cows producing large amounts of milk, and fed common winter rations, undergo constant losses of calcium, magnesium and phosphorus from their skeletons, suggest that large numbers of milk cows are suffering from a deficiency disease. These chemical analyses recall Hanau's report of almost thirty years ago, to the effect that the bones of pregnant women, who had enjoyed apparent health, frequently were the site of lesions resembling osteomalacia, an interesting observation that might be substantiated during life by means of recent genologic examinations."

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